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LARKSPUR, OR "POISON WEED."

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U. S. DEPARTMENT OF AGRICULTURE,
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OFFICE OF THE CHIEF.

Washington, D. C., March 10, 1913.

SIR: I have the honor to transmit herewith and to recommend for publication as a Farmers' Bulletin the accompanying manuscript, entitled "Larkspur, or 'Poison Weed,'" prepared by Dr. C. Dwight Marsh and Mr. A. B. Clawson, Physiologists, and Hadleigh Marsh, Laboratory Assistant, Poisonous-Plant Investigations, under the direction of Dr. R. H. True, Physiologist in Charge of the Office of Drug-Plant, Poisonous-Plant, Physiological, and Fermentation Investigations of this Bureau.

A detailed account of the experimental work on larkspur poisoning has been prepared. The demand for immediate information on this subject is so great, however, that it is deemed wise to issue in an abbreviated form the most important practical results of this investigation.

Respectfully,

B. T. GALLOWAY,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

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LARKSPUR, OR "POISON WEED."

INTRODUCTION.

The larkspurs have been known to be poisonous from the time of the ancient Greek and Latin writers to the present. It is only in North America, however, that they have been important as causing losses of stock. The recorded losses in North America have been almost entirely in the cattle ranges of the western United States and Canada, although isolated instances of poisoning are known in the eastern mountains. In the cattle ranges of the West probably no poisonous plants, with the exception of the loco weeds, have caused such heavy losses to the stockmen.

It is difficult to estimate with any degree of accuracy the extent of these losses. A conservative estimate based on reports from a large number of ranges indicates that the annual loss is from 3 to 5 per cent. A great many of the stockmen who have reported upon this subject have given an estimate of 5 per cent. Specific cases are known where from 20 to 50 cattle have died out of a single herd within a few hours, and other instances are recorded in which individual stockmen have lost as many as 200 head in a season. These are losses which are attributed to larkspurs, since they have occurred on ranges where the larkspurs are abundant. In most cases, however, definite evidence that the larkspurs were the cause of the losses is wanting. The animals are found dead in localities where they can obtain the plant, and it has been assumed that death was caused by eating these weeds.

A definite belief has been developed among the stockmen of the West that the larkspurs are poisonous, and the symptoms of larkspur poisoning have been described with great uniformity. Accounts of these losses have come from practically all of the cattle ranges in the mountains from the Rocky Mountains west. These ranges at the present time are very largely in the domain of the national forests, and a map of the national forests would give a fair idea of the distribution of larkspur poisoning.

LARKSPURS OF THE WESTERN UNITED STATES.

Two general groups of larkspurs are found on these ranges—the tall and the low larkspurs. The tall larkspurs grow in great abundance in the gulches and canyons of the more elevated cattle ranges, while the low larkspurs grow in similar regions, but upon the open hills and in drier localities.

In the regions where these plants are abundant they are commonly known as "poison," "poison weed," or "cow poison." In New Mexico the tall larkspurs are known as "peco."

TALL LARKSPUR.

In the mountains of Colorado the tall larkspur is represented by the species *Delphinium barbeyi*. This grows from an altitude of about



FIG. 1.—Tall larkspur (*Delphinium barbeyi* Huth) before blossoming.

8,000 feet to very near the timber line. When full grown it is from 3 to 7 feet in height, with a long woody root. The violet-blue flowers are in a dense terminal raceme. The plant starts growth early in the spring and in the region of the experiment station at Mount Carbon was from 1 to 2 feet high in May, forming bunches much more prominent than the grass and doubtless attractive to grazing animals. Figure 1 shows the plant as it appears in May before blossoming, and

figure 2 shows it in full bloom. It blossoms in July, the seeds are formed in August, and then it commences to dry up, but does not entirely disappear until broken down by the winter snows. This species is found in the mountains of Wyoming and Utah as well as those of Colorado.

The species found in Montana is *Delphinium cucullatum*. It is not so large as *Delphinium barbeyi*, and the flowers present a grayish blue appearance, as the sepals are gray, but the general habit of the plant resembles that of the tall larkspur of Colorado. In the other moun-



FIG. 2.—Tall larkspur (*Delphinium barbeyi* Huth) in full bloom.

tain ranges of the West the species of tall larkspur resemble these species very closely.

It is not difficult to distinguish the tall larkspur after it blossoms, as no other plant growing in similar localities has a flower at all resembling it. In the early stages, however, like that represented in figure 1, it is easily confounded with geranium and aconite, which frequently grow in great abundance in the same places. Figure 3 shows a plant of geranium (*Geranium viscosissimum* F. and N.) which may be considered a type of the species of geranium which are common in the mountain ranges. The leaves of this geranium resemble those of

the tall larkspur. The plant, however, has a very different habit and after blossoming is readily distinguished from the larkspur.

It is more difficult to distinguish the plant of the aconite, an illustration of which is given in figure 4. The plant shown, *Aconitum columbianum* Nutt., may be considered as typical of the aconites

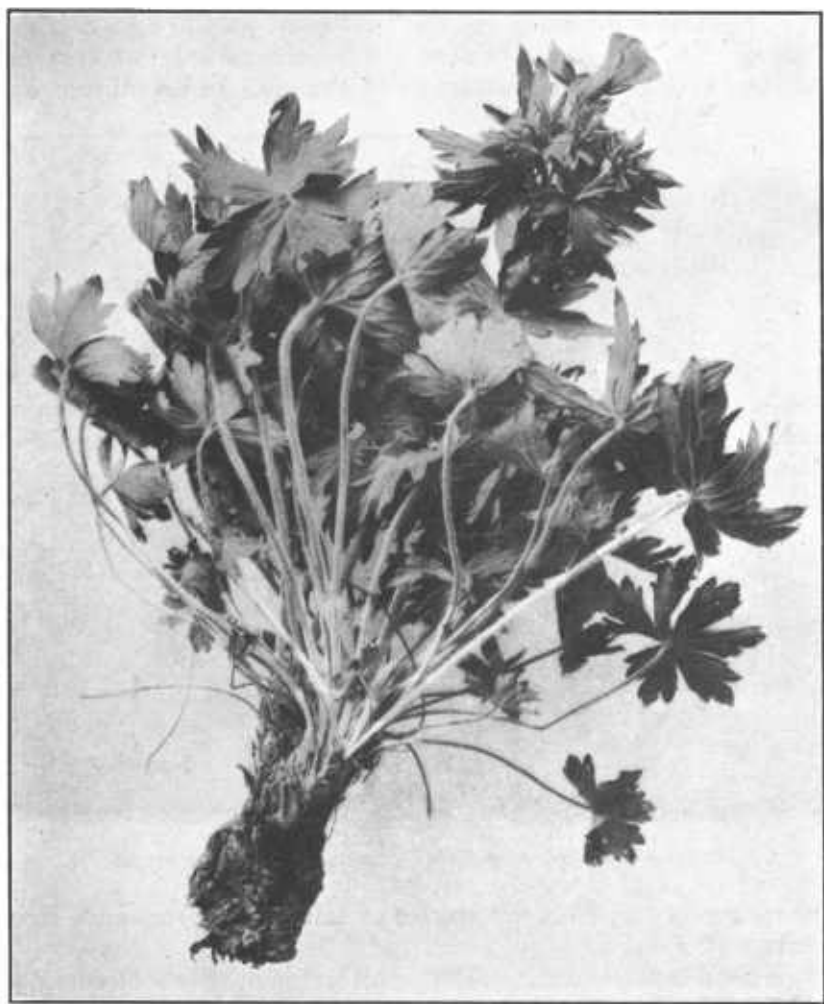


FIG. 3.—*Geranium viscosissimum* F. and N.

found in the mountain regions. Aconite, or monkshood, has a flower easily distinguished by its form from that of the larkspur, as will be seen by comparing figures 4 and 5. While the color of the flower is deep blue instead of violet blue, as in the larkspur, the leaves resemble those of the larkspur, although they are more closely attached to the

stem. The root of the aconite is short and bulblike instead of long and woody, as in the tall larkspur. These aconites frequently grow in considerable abundance in the midst of clumps of the tall larkspur.

LOW LARKSPUR.

Delphinium nelsoni may be taken as a type of the low larkspurs. This species (fig. 5) grows in considerable abundance in Wyoming,



FIG. 4.—*Aconitum columbianum* Nutt.

Colorado, New Mexico, and Utah, and this or a closely allied species grows in California and Oregon. It is found at altitudes of 4,000 to 10,000 feet on open hillsides and in parks, sometimes covering large areas. The root is short and tuberous, and the plant does not exceed a foot in height. The blossoms, which are violet blue and arranged in a loose raceme, appear in May, and seeds are formed in

the latter part of June, after which the plant dies and disappears. The species illustrated is rarely found after the first of July.

In the States north of Colorado a similar larkspur is found, known as *Delphinium bicolor* Nutt. This very closely resembles *Delphinium nelsoni* and has the same general habit of life. The root, however, is long and fibrous, and the blossoms are somewhat larger. It is the most beautiful of the American larkspurs.



FIG. 5.—Low larkspur (*Delphinium nelsoni* Greene).

SYMPTOMS OF LARKSPUR POI- SONING.

The first symptom of larkspur poisoning, as noticed on the range, is ordinarily the falling of the animal. When a bunch of cattle is being driven it sometimes happens that one or more will suddenly fall and commence to kick convulsively. In the experimental poisoning it was found that this falling was preceded by a lack of appetite and general

uneasiness, with a stiff and staggering gait. When the animal falls it ordinarily goes down very suddenly, the legs appearing to crumple up under it. In the lighter cases of poisoning the animal will hold its head erect and after a longer or shorter time will get upon its feet, only to fall again shortly. In more acute cases the animal lies upon its side with the feet extended more or less rigidly. In these cases it is entirely impossible for the animal to get upon its feet immediately. Occasionally it will fall once, remain upon the ground a short time, and then walk off as if nothing were the matter. More frequently the fall is repeated a

number of times. If the animal is hurried after being upon its feet the symptoms of poisoning will be more severe. When a bunch of cattle has been feeding upon a larkspur range and is started up suddenly it is not unusual for one or more of them to fall as the result of the larkspur poisoning. While the motions of the animal when down may be described as convulsive, it can hardly be said that the poison produces convulsions. The kicking seems to be due largely to attempts to rise rather than to involuntary contractions of the muscles of the legs.

Poisoned animals are almost always constipated and usually recover if this condition is relieved. In all severe cases the animals are nauseated and death frequently results from the contents of the first stomach getting into the windpipe. Bloating occurs in some cases, but not in all. When the cattle bloat, death in some cases is doubtless the result of mechanical obstruction of breathing. When the poisoning is sufficiently severe to produce fatal results death ordinarily occurs in a very short time. The symptoms of poisoning by the tall and low larkspurs are the same, and, so far as known, all the larkspurs of the West produce similar symptoms.

EFFECT OF LARKSPUR POISONING UPON ORGANS OF THE BODY.

Cattle fatally poisoned with larkspur bloat almost immediately after death. The autopsies show more or less inflammation of the stomach, of the small intestine, and of the lining of the windpipe. In most deaths from larkspur poisoning more or less of the contents of the first stomach will be found in the windpipe and in the bronchial tubes. The blood vessels of the surface of the body are greatly congested, and the kidneys ordinarily show extreme congestion. Death results from paralysis of respiration, the heart continuing to beat for an appreciable time after respiration has ceased.

PERIOD DURING WHICH POISONING OCCURS.

The low larkspur, as has been stated, is poisonous during the whole of its life, but the plant disappears the last of June or early in July. Poisoning from eating it occurs, therefore, only in the months of May and June. The tall larkspur grows through the entire season, and as it matures the leaves lose their poisonous properties, so that after the middle of August they cease to be poisonous. The seeds are more poisonous than the leaves, and occasionally cattle die rather late in the season from eating them. The loss from eating seeds, however, is very small.

Inasmuch as the tall larkspur plants are particularly attractive to animals before the blossoms are formed, it follows that the most

dangerous period of the tall larkspur corresponds very closely to that of the low larkspur, the larger number of cases of poisoning occurring in the months of May and June. Some animals may be poisoned in July, but such cases are comparatively rare. After the middle or last of August cattle eat the leaves of the tall larkspur with considerable eagerness and with no harm whatever. During the season when poisoning occurs apparently all parts of the plants above the ground are poisonous. The roots of the tall larkspur are never eaten by cattle, as they can not get at them. Contrary to the common belief of cattlemen, very few of the roots of the low larkspur are ever eaten by cattle, and the danger is not from the roots but from the parts of the plant growing above ground.

QUANTITY OF LARKSPUR NECESSARY TO POISON.

Small quantities of both the tall and the low larkspurs can be eaten with impunity. Experimental work shows that an animal must eat about 3 per cent of its weight before being affected, and that average cases eat from 8 to 9 per cent of their weight.

POISONING OF HORSES.

Experimental work showed that horses are poisoned by larkspur if they eat a considerable quantity. On the open range, however, it appears that horses never eat enough of the plant to produce any effect, so that horses can be grazed with impunity upon ranges which would be fatal to cattle.

POISONING OF SHEEP.

Careful and extended experiments upon the tall and low larkspurs growing about the Mount Carbon experiment station in Colorado showed conclusively that sheep can graze upon these plants without any harm. Corral feeding experiments showed that sheep can eat very large quantities of larkspur not only without harm but with apparent benefit. The experimental work at the Greycliff station in Montana corroborated that in Colorado, and there is every reason to believe that sheep are never injured by feeding upon the larkspurs.

TREATMENT.

It is of course best, if possible, to avoid larkspur poisoning by handling stock in such a manner that they will not get at the plants in any quantity. No hesitation need be felt in ranging horses and sheep on areas infested with larkspur. Cattle can eat considerable

quantities without harm, but it is always dangerous to permit them to graze freely upon a larkspur area. This has been recognized by the stockmen on some of the ranges, who by keeping their cattle from the infested area until about the first of July prevent losses. This can be done either by riders, as in some sections, or by the aid of drift fences. In some cases, where limited areas are particularly infested with these plants, it may be desirable to fence them in and keep the cattle out. In some areas, where the plant grows in great abundance in gulches frequented by cattle, it is entirely practicable to dig out sufficient of the tall larkspur so that the animals can graze in those regions with impunity. Where the tall larkspur grows widely scattered over a range it is impracticable to destroy it by digging. It is well known by stockmen, however, that some gulches are veritable death traps for their cattle, and in those places it would be a matter of economy to go over the area and destroy most of the plants of the tall larkspur before the cattle are admitted.

MEDICINAL REMEDIES.

When cattle are grazing freely upon a range containing larkspurs and are not immediately under the supervision of riders, deaths from larkspur can not be avoided. In cases, however, where the poisoning occurs, as frequently happens, while animals are being driven from one range to another and are under the control of riders, it is sometimes possible to apply remedies which will aid recovery. Many of the cases in which poisoning is not severe will recover if care is taken to turn the animal after it falls, so that the head will be higher than the rest of the body, and to see that it is not further disturbed. Any attempt to get the animal upon its feet or to drive it rapidly is almost certain to be followed by fatal consequences. If the animal bloats badly it should be relieved by paunching, that is, thrusting a trocar into the rumen in the manner which is practiced by so many of the stockmen of the West. It is not clear that bleeding produces any good effects.

When the animal is very weak, subcutaneous injections of 20 cubic centimeters (6 drams) of whisky will aid in bridging over the period of weakness and sometimes save the animal. In all cases it was found in the station work that beneficial results were obtained by using a subcutaneous injection of the following formula :

Physostigmin salicylate	1 grain.
Pilocarpin hydrochlorid	2 grains.
Strychnin sulphate	$\frac{1}{2}$ grain.

This formula would apply to an animal weighing 500 or 600 pounds. For a large steer or a cow of 1,000 pounds or more the dose should be twice that given in the formula. These materials can be obtained from any dealer in drugs. The physostigmin salicylate and pilocarpin hydrochlorid are furnished in veterinary hypodermic tablets, each containing one-half grain of physostigmin salicylate and 1 grain of pilocarpin hydrochlorid. The strychnin sulphate can be obtained in tablets each containing one-half grain. These dissolve readily, and it is well to have two or three doses ready in small homeopathic bottles. For yearlings one should use two of the physostigmin pilocarpin tablets and one of the half-grain strychnin tablets dissolved in enough water to half fill an 8-dram homeopathic bottle; for full-grown cattle four of the physostigmin pilocarpin tablets and two of the strychnin tablets dissolved in an 8-dram bottle full of water should be used.

It is best to use an all-metal hypodermic syringe. This can be easily cleaned by boiling. The form which has been found most useful for the field is that known as the Quitman syringe. In this the needles are carried in the hollow piston, and a case is therefore unnecessary. The syringe should be of the 10-centimeter size, which holds half an 8-dram bottle of water, so that the remedy can be given to yearlings in a single dose, while for mature cattle the syringe must be filled twice. The needle is most conveniently inserted in the shoulder.

Stockmen at the present time are accustomed to the use of a hypodermic syringe, and if they are willing to try this remedy can without doubt save the lives of most of the animals poisoned during drives or round-ups. This remedy relieves the condition of constipation and stimulates the respiration.

If it were possible to insure free action of the bowels before cattle were driven over a "poison area," probably most of the poisoning would be prevented. Experimental work is being carried on with the view of accomplishing this result in specific cases.

PASTURING SHEEP ON PRESENT CATTLE RANGES.

It is evident that ranges which are particularly harmful to cattle may be used with impunity for the pasturage of horses or sheep. It is suggested that certain ranges where the losses of cattle have been extremely heavy may profitably be changed to sheep ranges; or it may be possible to graze sheep upon the larkspur areas, and thus avoid the danger of loss to cattle. On some ranges it might be well to graze both cattle and sheep under the same ownership.

SUMMARY.

(1) While the investigations outlined in this bulletin were carried on mainly in Colorado and apply more particularly to the larkspurs of that State, conditions in the other Western States with mountain cattle ranges are very similar.

(2) The tall and the low larkspurs cause the loss of a great number of cattle in the mountain ranges of the West.

(3) These losses occur almost entirely in the months of May and June, although some may occur in the early part of July.

(4) Horses and sheep are not injured by grazing on larkspur areas.

(5) Poisoning may be largely prevented by keeping cattle away from the poison areas until about the end of the first week of July.

(6) Cattle poisoned by larkspur should be kept as quiet as possible, should be paunched if bloating occurs, should not be bled, and may in many cases be saved by a subcutaneous injection of physostigmin salicylate, pilocarpin hydrochlorid, and strychnin sulphate.

